

Lecture 3: Unity: more visuals and moving in the world

Class topics

- Assignment 1 review with examples
- Adding the ability to move through the world – Starter Assets overview
- Adding a First Person Controller to your world
 - Review the FPC Playground demo
 - Add the FPC to your Scene.
- Custom Gameobjects
- Adding new functions to your game/scene/environment: Package Manager
- Background information on 3D models – advice for downloading useful Assets
 - URP and HDRP – links to tutorials
- Homework

Assignment 1

Sample files located at Lecture 3 > resources folder for Mark Horgan, Alexandra R, Keith Molloy

Mark Horgan – Meteora

This is a virtual experience of a culturally interesting location - Meteora in Greece. It might be used by the regional tourist board of the area creating a VR application for the Oculus App Store to encourage people to visit mainland Greece rather than heading straight for the islands.

Meteora has unique enormous rock columns where monks, in the 14th century, built more than twenty monasteries to evade the Turkish raiders. Six remain today while the project contains four.

Alexandra Rosenberger

The project is called “Forest of Music”, a gaming application of a nature setting guided by a musical composition. The player is guided on a path towards a magical sphere in a cave, the source of the music, with a view towards revealing layers of the composition and complete the musical piece. The world, as well as the piece, are reminiscent of games such as Skyrim as well as the respective musical score. Further inspiration has been drawn from Fantasy TV shows such as Game of Thrones (see Picture 2).

Keith Molloy

SpectrumVR is an interactable environment where the player must use the tools at their disposal to solve a set of puzzles

Had viewed work by the artist, Do Ho Suh, who creates these interactable spaces made from some sort of wireframe and various colourful meshes that emulated everyday living spaces to neoclassical structures. In SpectrumVR, the player has to use colour to solve puzzles in the environment, and they use the RYB colour wheel with the different colour relationships being the key.

This has a strong educational basis, as young students in an art class could interact in this environment to learn about these colour relationships in an exciting way. The environment

itself only consists of two dodecahedron structures that the player moves between. The player uses their colour wheel and their controller ray to assign the appropriate colours to interactable game objects.

LET'S ADD MOVEMENT AND THE ABILITY TO GET AROUND:

ADDING a First Person Controller to your world

- Unity has replaced the Standard Assets kit (used up to version 2019) with the Starter Assets (for the latest Unity 2020 LTS).
- Starter Assets contain 2 different packages available on the Assets store
- Starter Assets are:
 1. First Person Controller and Third Person Controller are contained. We are only interested in the FPC as it provides a Point-of-View shot and movement through the world, which would be similar to a VR experience.
 2. They are prefabricated (prefab) and designed to give you a quick start into prototyping and building character controllers for various game genres, through systems and methods that allow you to easily build and expand on just about any type of project.
 3. The Starter Asset packages allow you to jump right POV shot and movement – no matter your previous experience or expertise. These starter packages use the Input System in a character controller with the built-in CharacterController component. So, you the usual controls that you would find in a game controller are available e.g. WASD for movement, mouse to look around etc.
 4. The Starter Assets are split into two separate Asset Store packages:
 - A first-person character controller (like the student's examples we viewed) is needed for Assignment 1
 - A third-person character controller is also available:
<https://www.youtube.com/watch?v=ZSj4WnAmnyU>
 - You can quickly download and import the controller you need for your project directly from the Asset Store. Both controllers are built in the same modular way and based on the same scripts and logic.

Commented [FC1]: [Unity Starter Assets In-Depth Overview | 1st & 3rd Person Controller w/ Input System & Cinemachine - Bing video](#)

<https://blog.unity.com/games/say-hello-to-the-new-starter-asset-packages>

Commented [FC2]: <https://blog.unity.com/games/say-hello-to-the-new-starter-asset-packages>
<https://www.youtube.com/watch?v=4QuPIKzdz14>

Overview of controller assets

Link to FPC is here:

<https://assetstore.unity.com/packages/essentials/starter-assets-first-person-character-controller-196525>

Important note:

Compatible with 2022.3 LTS!

- The Starter Assets packages are also compatible with Unity 2020.3 LTS and Unity 2021.3 LTS. *If you are working with an earlier version of Unity, you will need to get the Standard Assets Kit.*

- The First/Third Person Starter Assets packages require the Input System and Cinemachine packages to work. The packages will automatically install when you import a Starter Assets package into your project.

INSTALLATION INSTRUCTIONS: you will have already done these steps:

Access them on the Unity Assets store:

<https://assetstore.unity.com/packages/essentials/starter-assets-first-person-character-controller-196525>

- Download and import into Unity. Window > Package manager > My Assets – find, download, import and check that they are in the Assets folder.
- Two Unity packages are required for the Starter Assets:
- Cinemachine and the InputSystem.
- They will automatically be installed when you import either the First/Third Person starter assets into your program.
Cinemachine appears in the GameObject Menu list. It is suite of tools that allows you to do more cinematic camera shots and behaviours. Main Camera is the default but you can do more with Cinemachine cameras such as smooth dolly movement, movement around an object, colour grading. Cinemachine won an Emmy for technical contribution to cinematography. If you are interested in developing for film or animation or worlds with rich visuals and movement, more info here: <https://unity.com/unity/features/editor/art-and-design/cinemachine>
- InputSystem – check File > Build Settings > Player settings > note that Input System Package is there (this relates to mouse and keyboard input and control). Note that there is an Input Manager there – view it: recommendation to use the Input System Package instead. NB: you would use Input Manager with earlier Unity versions.
- You can access Starter Assets via the Tools menu option – Tools menu > Starter assets > options presented:
- Reinstall Dependencies will verify if the Starter assets packages were installed and that all features are ready. So, choose Reinstall Dependencies to check. If they are not installed, it will reimport and install.

ADD the FPC controller (FPC) to your Scene

- Tools : Starter Assets > Reset First Person Controller – automatically adds the FPC to your Scene.
- Do the Reset and notice what has been added to the Hierarchy window and the Scene window.
- Undo for now.

Take a look at First Person Controller in the DEMO Scene:

- Let's look at what is possible with the FPC
- Look at the demo: Assets > StarterAssets > FirstPersonController > Scenes > Playground scene (Unity icon).
- Press Play to enter the Game. Note the Game window has opened. In Play mode, we can move around the environment, using WASD keys or arrow keys, and mouse.

NB: If your WASD/arrow keys are not working:

Edit > Project Settings > Player > Other Settings > Configuration > Active Input Handling > choose Input System Package (New)

This was an issue with Unity 2021 but should be resolved in 2022.

- Can use left joystick if connected; can look around with the mouse; press Shift to sprint and spacebar to jump.
- **Take 1 minute to explore**
- Esc game (press Esc key and click off the play button) and select UI_Canvas_starterAssetsinputs....in Hierarchy.
 - o View Inspector and note that this is turned off (checkbox is not checked). This gives you access to a set of mobile controls in the Scene – buttons to allow you to move around and have functions via the buttons, if you need them.
 - o Default is to leave them off. Check the box to see the buttons appear.

These buttons would be useful for a touchscreen/kiosk application, where there are no external controls.

- There are **3 essential prefab** (prefabricated) GameObjects that make the FPC work. They can be viewed in Hierarchy and are: **MainCamera**, **PlayerFollowCamera** and **PlayerCapsule**.
 - o **MainCamera** - contains CinemachineBrain component that will be used by the PlayerFollowCamera – **view in Inspector**
 - o **PlayerFollowCamera** contains the CinemachineVirtualCamera that moves and rotates based on the player's position and look direction - **view in Inspector**
 - o **PlayerCapsule** contains the input actions for using with the input system (keys, arrows, mouse etc) along with the First Person Controller script which allows you to change and finetune the controller's behaviours and actions - **view in Inspector**. Here is where you could consider making some small changes to how your FPC appears to the player
 - You can change settings like the FPC's ability to:
 - Move, sprint, speed of rotation
 - Jump height
 - Detection of the ground they are on.
 - Object's push abilities

HOW TO ADD THE FPC TO YOUR WORLD

- Exit the Playground demo and open your own world's Scene. Best to open a Scene that you have been adding assets to since Lecture 2.
- We do not want to have 2 cameras in the Scene.
 - o As you recall, the FPC has a camera (MainCamera)
 - o The default 3D Scene has a Main Camera – we want to remove this functionality
- Remove the scene's current Main Camera in 2 ways: A. You can uncheck it in the Inspector window – Hierarchy > Main Camera > Inspector window and check box to hide it. (To the left of the title Main camera). B. Delete the Main Camera > Select the Main Camera Gameobject > rightclick > delete.
- To add FPC - Tools > Starter Assets > Reset First Person Controller. The FPC MainCamera is now allowing you to see the world.
- If you want to move the FPC, you need to move the PlayerCapsule so make sure the PlayerCapsule is selected in the Hierarchy.
- Set the PlayerCapsule position to where you want it to start in your Scene.
 - o Think about what you want the player to see when they arrive in your world.
 - o If it is in the Scene, doubleclick in the Hierarchy to find it and move it to the desired location. Notice where the camera is facing. Use the Game window to get a preview of the player camera view so you can move it.
 - o You should now be ready to explore the environment in First Person mode. Press Play and play the game: use the WASD keys, Shift, spacebar and the mouse

- o (Important for versions earlier than 2022.: PlayerFollowCamera object > CinemachineVirtualCamera > Follow > check that the follow target is set to the PlayerCameraRoot within the PlayerCapsule object. (If not, expand the PlayerCapsule object and drag the PlayerCameraRoot onto the Follow target.))

Now that you have added a player, continue making the environment

Some ideas for continued development:

- Locate FPC (doubleclick it to find on the ground) and play game. Take some notes as to where you would like to put objects
- Sketch a map of the world, with start point, destination and some interesting items to see/interact with along the way
- Consider using an image/map of a real world place to help you design the world – Examples: Mark Horgan's piece, Niamh Daly O'Mahoney's piece

Example: Tara Scanlan <https://vimeo.com/manage/videos/678146389> password:
intro_to_xr_taraScanlan

Tutorial/Homework material

- Select Terrain > Paint terrain > select 5th brush and paint on terrain – cover all ground. Play Game and walk around Scene.
- Paint brush > Raise or Lower Terrain – alter shapes in the terrain. Play game and walk around. Try different brushes on the terrain.
- Add objects like buildings etc to force the player around.
- Cover the entire terrain. Use different brushes if needed.
- Make alterations such as raise ground and lower it.
- Place Trees: Try to keep at default and be realistic – space the trees apart. Make a forest! Play and walk around.

- Extra material

Touchscreen interface development using the UI prefab: from 6 min 49 secs
<https://www.youtube.com/watch?v=4QuPIKzdg14>

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Tutorial/Homework material: Add Custom GameObject of your own design

- Up to now you have been adding gameobjects from the menu - lots of objects to choose from but they have specific components
- Customising empty GameObjects is useful if you want specific behaviours/functionality/look for an object. For example, you might want to add audio to a particular area in your world e.g. ambient audio in a lush meadow, but you don't want us to see a particular object. Example: Alexandra's project.

All Components are accessible to all GameObjects already in or that you create in your Scene. This is useful if you want to add a series of Lights or Audio, for example. View an object in the Inspector window and scroll down to see where you can add from a list of components.

Class work: take 1 minute to review some components.

You can create new objects yourself using Empty GameObjects.

1. Make new lights:

- a. In your Scene > GameObject > Create Empty > Select GameObject in Hierarchy > View in Inspector > scroll down to Add Component. Search for the feature e.g. Light and add that Component. Then change some properties e.g. Type of light – change from Point to Spot. Select another parameter to change e.g. colour

- o Rename the GameObject to GreenSpotLight (right-click > Rename).

- If you would like multiples, you can then duplicate it and know exactly the behaviour/settings. (Right-click > Duplicate and rename the new version.)

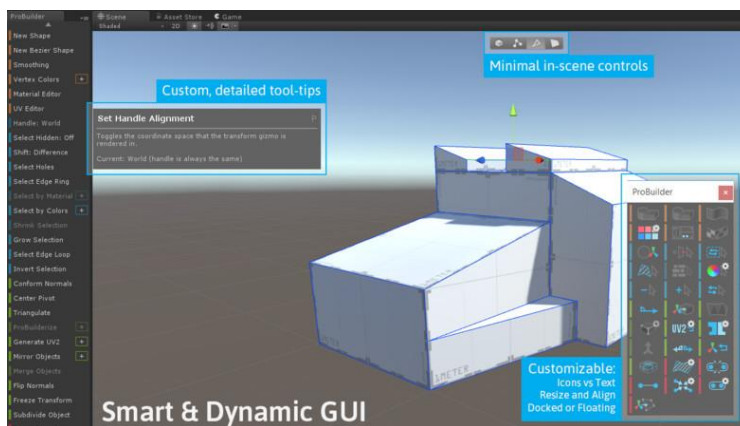
2. **Make new Audio sources** > Create Empty > Add Component. Search for the feature e.g. Audio Source and add that Component. Then change the properties. Rename this to something that makes sense to you like BirdSongaudio. You can add audio to it by clicking into AudioClip and the icon to the right to select an audio file. Position it somewhere in the world. (We will work with this when covering audio in Unity)

Tools in the Package Manager

Package Manager. Useful for functions that you might add to your game.

- Window > Package Manager > Packages: In Project > switch to Unity Registry – should see a long list, categorised by topic. *Explore anything that seems of interest to your work.* Some useful packages, that you might want to explore, include:

1. **ProBuilder** for custom geometry e.g. when you are creating a building.



Unity tutorial link: [Working with Shapes in ProBuilder - Unity Learn](#) – this will get you started in using ProBuilder and you can explore other interesting lessons.

Example: Rooftopia by [Justinas Kuprys](#) – Demo of the application

Commented [FC4]: <https://assetstore.unity.com/packages/p/25-mixed-industrial-sign-pack-73180>
<https://assetstore.unity.com/packages/3d/props/apartment-kit-124055>
<https://assetstore.unity.com/packages/p/big-furniture-pack-7717>
<https://assetstore.unity.com/packages/3d/props/exterior/city-assets-volume-1-free-183261>
<https://assetstore.unity.com/packages/3d/props/industrial/industrial-models-171071>
<https://assetstore.unity.com/packages/3d/props/interior/interior-props-pack-asset-86452>

2. **Postprocessing** – allows you to add effects and filters to your cameras that can give your visuals a more cinematic look. Quick tutorial on this here: [FPS Mod: Adding post-process effects - Unity Learn](#) - 10 mins

Tutorial links:

- a. Get started with a 10 minute tutorial - <https://learn.unity.com/tutorial/fps-mod-adding-post-process-effects#>
- b. <https://learn.unity.com/project/creative-core-post-processing> - 2 hours

Examples:

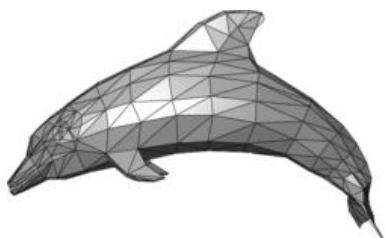
- Sofia Harmen – Smullonstralle – use soft filter
- o Patrick Conneely – Croatan mystery – Vignette effect - <https://vimeo.com/672347157> pass:mmt2021_patrick



BACKGROUND INFORMATION on 3D models – information for when you are selecting Assets for use

models on the Assets store comply with these guidelines

1. Low polygon count in 3D meshes and models:



Low poly is a polygon mesh in 3D computer graphics that has a relatively small number of polygons. Low poly meshes occur in real-time applications (e.g. games) as contrast with high poly meshes in animated movies. The term *low poly* is used in both a technical and a descriptive sense; the number of polygons in a mesh is an important factor to optimize for [performance](#) but can give an undesirable appearance to the resulting [graphics](#).^[1]

==Necessity for low to allow display by a computer. Polygons can, in theory, have any number of sides but are commonly broken down into [triangles](#) for display. In general the more triangles in a mesh the more detailed the object is, but the more computationally intensive it is to display. In order to decrease render times (i.e. increase [frame rate](#)) the number of triangles in the scene must be reduced, by using low poly meshes.^[2]

2. Snap to origin in 3d modelling tool

Make sure that the prefabs have the correct orientation i.e. Position, rotation set to 0

3. Make sure animations are simple

If you are importing an animation, make sure it doesn't do too much!

4. IMPORTANT: Compatibility with the Built-In Render Pipeline/Universal Render Pipeline/High Definition Render Pipeline

The **Built-in Render Pipeline** is Unity's default render pipeline. It is a general-purpose render pipeline that has limited options for customization.

The **Universal Render Pipeline (URP)** is a Scriptable Render Pipeline that is quick and easy to customize, and lets you create optimized graphics across a wide range of platforms.

The **High Definition Render Pipeline (HDRP)** is a Scriptable Render Pipeline that lets you create cutting-edge, high-fidelity graphics on high-end platforms. For example:

<https://assetstore.unity.com/packages/vfx/particles/butterflies-pack-3d-141259> is compatible with all three.

NB: As you identify assets on the Store, examine these details and ensure that you are using assets that are compatible with the Built-In Render Pipeline. URP and HDRP would be worth exploring if you are doing more advanced graphics work at a later stage.

URP AND HDRP TUTORIALS:

URP: <https://learn.unity.com/tutorial/introduction-to-urp#> - 10 mins

HDRP: <https://learn.unity.com/tutorial/introduction-to-hdrp-2019#> 10 min

Tutorial/Homework

Explore Assets in the Unity Store and check for the above points in the information

Class work: Search for animated characters – e.g. elf, gorilla, butterfly, landscape environments – natural and urban

Assets > Butterfly animated folder : prefab and add to your Scene. Save and play game to see the animation. <https://assetstore.unity.com/packages/p/butterfly-animated-58355>

5. File formats:

.fbx – most common. Supports inclusion of textures, materials, animation and the 3d meshes in the same file. TRY TO CHOOSE this format.

Texture formats: best is .png. High quality and includes alpha channel. Psd and tiff also good as you can bring in layers.

Class/Homework: If you have an image file made in Photoshop, try importing it to see how it performs

Importing your own Assets: for anyone who has 3D model design experience (useful if you want to use something you created yourself)

- (For testing purposes, look on Free3D for .fbx assets to add to your game. Remember: Unity can only import .obj or .fbx
- Create new folder in Assets and call it eg. MycustomModels. Go to the Download location of fbx file and copy it directly to the new folder. Should be able to see the files in your folder, within Unity.
- **Maintain Unity settings that may have been created by a developer:** Assets menu and import package > custom package and import the package you want.

Homework:

1. Watch:
 - a. Unity Terrain tool – build terrains with Unity 2019 – some tips <https://www.youtube.com/watch?v=aExdxF4OKBo>
 - b. Terrain Tips and Tricks: https://www.youtube.com/watch?v=bq_PIBWw5oI
 - c. Postprocessing package – if this is something you might use, install and explore

- d. Probuilder - if this is something you might use, install and explore
- 2. Assignment 1 progress:
 - a. Decide on the visual space for your assignment and start designing. Think about the POV of your player (height, footsteps)